REMARKS

In view of the foregoing amendments and following remarks responsive to the Office Action of June 17, 2004, Applicant respectfully requests favorable reconsideration of this application.

Claims 1-9, 11, 13-21, 23, and 25-26 are pending in this application. Applicant thanks the Examiner for the withdrawal of the rejections of claims 10-12 and 22-24 under 35 U.S.C. §112 and the withdrawal of the previous prior art rejections.

However, the Office has asserted new rejections. Particularly, in Sections 4, 5 and 6, the Office objected to claims 11, 23 and 13, respectively, due to certain informalities. Applicant has herein amended those claims to improve their form accordingly.

In Section 7, the Office objected to claims 25 and 26 because the value $P_{G-1|G-1}$ $(F)_{(G-1)}$ was inconsistent in lines 4 and 14 in each claim. The Office's point is well taken. In fact, in all four instances, in claims 25 and 26 as well as in claim 23, that value contained typographical errors. Applicant has corrected the value in all instances and it is now consistent with the specification and claims as originally filed. Particularly, the equation appears without typographical errors in the application as filed in, for instance, claims 10, 11, 22, 23, and 24 and on page 24, line 5.

In Section 8 of the Office Action, the Office rejected claims 1 and 13 under 35 U.S.C. § 112, first paragraph. Particularly, the Office asserted:

18

Regarding claims 1 and 13, the claims are not enabled because the weighing and combining of the outputs of N antenna receiving elements is claimed as being dependent upon a beam scheduling sequence although the generation of the beam scheduling sequence is independent of the generation of a single beam according to the combining of the outputs of the antenna array as described in the specification. The claims are not enabled because the generation of a single beam according to the specification is based upon the combination of the outputs from the antenna array only rather than being based upon the beam scheduling sequence as well. One skilled in the art is not enabled to create a single beam by the beamforming circuit according to the beam scheduling sequence. While the sequence of the generated beams may be enabled according to the beam scheduling sequence, the weighting and combining of the antenna array to create a single beam according to the beam sequence is not.

Applicant is not entirely certain that it understands this rejection. It appears that the Office is asserting that the specification does not disclose that the beam generating circuit weighs and combines the signals from the antenna array. If so, Applicant respectfully traverses insofar as the recitation that the weighing and combining of the antenna outputs to create a single beam is in accordance with the beam sequence generated by the beam schedule generating circuit is found on page 26, lines 8-17. The actual formulae utilized by the beam schedule generating circuit is disclosed in detail in Sections II and III of the specification.

If Applicant's above-discussed understanding of this rejection is erroneous, Applicant respectfully requests the Office to clarify the rejection in the next Office Action.

Accordingly, Applicant respectfully requests the Office to withdraw this rejection.

In Section 10 of the Office Action, the Office rejected claims 4 and 16 under 35

U.S.C. §112, first paragraph, as non-enabled stating that the specification "does not

reasonably provide enablement for switching at a rate faster than the chip rate." The

Office stated:

> Regarding claims 4 and 16, the specification does not enable one skilled in the art to switch beams by a beamforming circuit at infinitely fast speeds. Indeed, the claimed limitation necessarily includes that which is impossible to achieve being an infinitely fast switching of beams according to a beam scheduling sequence. There is no matter of an amount experimentation to consider regarding the enablement of the claims. Because the claim language of "faster than a data rate" includes any speed that is faster than a data rate, it is including all switching speeds of the beams faster than that of the data rate including an infinitely fast rate which can not be enabled by any disclosure because it is not possible to achieve.

Applicant respectfully traverses. The propriety of claim terminology such as

"greater than" or "faster than" is well accepted. In essence, the Office is asserting that

any claim recitation that encompasses infinity is improper. Thus, for instance, under

the Office's logic, a claim recitation of a "car having at least four wheels," is not enabled

because it encompasses an infinite number of wheels, which, of course, is impossible.

This is incorrect claim interpretation. The question is not whether the specification

supports every number of wheels between and including four and infinity. The question

is whether the specification supports any single number of wheels between and

including four and infinity. In short, the claim is enabled, because as admitted by the

Office in this very rejection, the specification does enable beam switching at a rate that

is faster than the data rate at the signals in the reception channel. Nothing else is

20

required. It is not necessary in order for this limitation to be enabled that the specification support <u>every</u> way encompassed by the claim language. Accordingly, this rejection should be withdrawn.

In Section 12 of the Office Action, the Office objected to claims 25 and 26 under 35 U.S.C. § 112, second paragraph, as being indefinite. Particularly, the Office asserted the function "$argF_{G-1}maxTr$" should be defined.

Applicant respectfully traverses. Particularly, all of the variables in the claim are defined in the claim. $ArgF_{G-1}maxTr$ is not a variable. It is two separate mathematical functions, namely, argmax and Tr, both of which are well-known mathematical functions, and one variable, namely, F_{G-1}. The variable F_{G-1} is already defined in the claims. Argmax is a mathematical function meaning the value that has the highest magnitude over all possible values of the variable given in the subscript (which is F_{G-1} in this case) when applied to the argument of the function (the argument being the equation within the brackets following the function, which, in this case, is $Tr(JP_{g-1|g-1}(F_{g-1}))$. The Tr simply indicates the well–known trace function, i.e., the argument of the argmax function is the trace of $JP_{g-1|g-1}(F_{g-1})$.

Accordingly, Applicant respectfully requests the Office to withdraw this rejection.

In Section 15 of the Office Action, the Office rejected claims 1-2 and 13-14 under 35 U.S.C. § 103 as unpatentable over the admitted prior art as shown in Figure 1 view of Kuwahara. In short, the Office essentially asserted that the admitted prior art according to Figure 1 discloses most of the claim limitations except for a beam

scheduling sequence or a beam schedule generating circuit for generating the beam

scheduling circuit for switching between the plurality of beams. The Office asserted,

however, that Kuwahara teaches a beam schedule generating circuit (Figure 4,

reference numeral 8; Figure 5, reference numeral 8) and the generation of a beam

scheduling sequence (col. 3, lines 10-20 and col. 4, lines 55-56). The Office asserted

that it would have been obvious to make the proposed combination because it could be

used to increase a subscriber's capacity.

Applicant respectfully traverses. In accordance with the present invention, the

beams are weighted and combined immediately out of the antenna array elements in

the N by 1 beamforming device under the control of the beam schedule generating

circuit 140. One of the many advantages of this is the reduction (relative to the

admitted prior art of Figure 1) of the necessary number of each of the frequency down

converting circuits, analog-to-digital converters, and multi-path and multi-user channel

estimators to one each. See for instance, the specification at page 6, lines 7-23 and

page 7, lines 9-14.

The Office is relying on Kuwahara as teaching the N by 1 beamforming device

114 of claim 1. However, Kuwahara does not disclose an N by 1 beamforming device

that results in the reduction of frequency down converting circuits and analog-to-digital

converters and channel estimators to one. Instead, Kuwahara actually teaches what

appears to be an N by N beamforming device which still requires N frequency down

converting circuits, N analog-to-digital converters, etc. Furthermore, while column 5,

lines 15-18 of Kuwahara does discuss "combin[ing] signals received by a plurality of arbitrary beams thereby realizing an up-link traffic channel in which an interference of other stations is suppressed", this portion of Kuwahara is discussing combining a plurality of beams after they have been frequency downconverted and analog-to-digital converted. Furthermore, note that Kuwahara does not even have a minimum variance, multi-path and multi-user channel estimator, as in the present invention. Rather, he selects the beam having the largest electric field strength. Column 5, lines 10-12.

Thus, in essence, Kuwahara discloses an even simpler version of the type of prior art represented in admitted prior art Figure 1 of the present application. Specifically, note that Kuwahara, column 4, line 50 through column 5, line 9 discloses that the traffic combining referred to in the above-quoted column 5, line 15 occurs in the beam switcher 8 of Figure 4, whereas the frequency down conversion occurs in beam generator 1 of Figure 4. See, specifically, column 5, lines 3-5, which discloses that "the traffic channel information is spread, modulated and multiplied with other traffic channel information by the beam generator 1 and then transmitted via the array antenna 17." Also, note that it is quite apparent from Figure 4 of Kuwahara that the number of inputs from the antenna array (represented by the vertical lines between antenna array 17 and beam generator 1 in Figure 4) is equal to the number of output lines from the beam generator (represented by the vertical lines extending between beam generator 1 and beam switcher 2 in Figure 4). Thus, it is clear that the "beam selection" in Kuwahara occurs in the digital domain in base station controller 8. Accordingly, Kuwahara is

23

substantially similar to admitted prior art Figure 1 of the present application with the difference being that instead using a minimum variance selector 22 to select the beam as shown in Figure 1 of the present application, Kuwahara uses an electric field strength detector to select the beam.

Thus, referring to claim 1, Kuwahara does not disclose "an Nx1 switched beam beamforming circuit for weighting and combining outputs of N antenna receiving elements and generating a single beam signal therefrom". Rather, as noted above, Kuwahara appears to disclose an NxN beamforming circuit followed by N frequency-down-converting circuits and N analog-to-digital converters, followed by an electric field strength detector.

Thus, not only does Kuwahara not disclose that for which it has been cited, but it actually teaches away from the present invention in that it teaches a circuit that is even further away from the present invention than the admitted prior art of Figure 1.

Independent claim 13 contains substantively similar limitations as claim 1. Accordingly, both independent claims 1 and 13 patentably distinguish over the asserted prior art. Claims 2 and 14 depend from claims 1 and 13, respectively. Accordingly, they distinguish over the prior art for at least the same reasons.

The Office rejected the remaining claims, claims 3-9 and 15-21, under 35 U.S.C. §103 as being obvious over the admitted prior art in view of Kuwahara and further in view of Chang. Particularly, Chang is cited as allegedly teaching some of the elements of the dependent claims. A detailed discussion of Chang is not necessary as Chang

clearly does not teach the above-discussed elements of claims 1 and 13 that are lacking from the admitted prior art and Kuwahara.

Each of claims 3-9 and 15-21 depend from one of claims 1 or claim 13 and, therefore, distinguish over the prior art for at least all of the reasons set forth above in connection with claims 1 and 13.

In reviewing this application is preparation for filing this response, Applicant has detected further typographical errors in the specification and corrected them herein. The errors and remedial amendments are self-explanatory.

Applicant also has reviewed the claims for form and made minor amendments to improve their form. For instance, the beam output by the Nx1 switched beam beamforming circuit originally recited in independent claims 1 and 13 is referred to later the claim sets as "said beam signal". Accordingly, Applicant has amended independent claims 1 and 13 to recite a "beam signal" instead of simply a "beam" in order to make the claim language more internally consistent. Also, in claims 4 and 16 "said selected beam" has been changed to "said beam signal" in order to be more linguistically consistent with the other claims.

In view of the foregoing amendments and remarks, this application is now in condition for allowance. Applicant respectfully requests the Examiner to issue a Notice of Allowance at the earliest possible date. The Examiner is invited to contact

Applicant's undersigned counsel by telephone call in order to further the prosecution of this case in any way.

Respectfully submitted,

Theodore Naccarella
Registration No. 33,023
Synnestvedt & Lechner LLP
2600 Aramark Tower
1101 Market Street
Philadelphia, PA 19107
(215) 923-4466
Attorneys for Applicant